Coherent Diffractive Imaging with Multiple Phase Fronts

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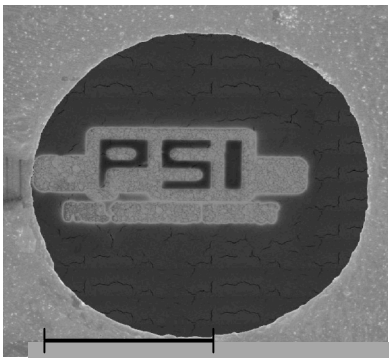
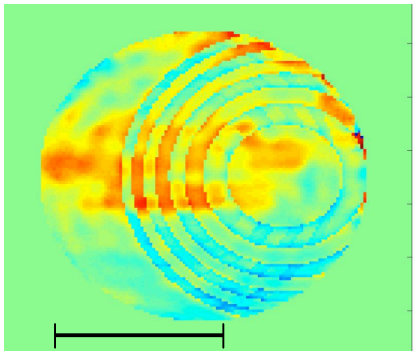
X-ray diffraction imaging is a promising technique for biological samples on the nanometer scale. The key task is to determine the absent phase information in the recorded diffraction pattern. Phase retrieval methods employ iterative algorithms [1-4] to computationally solve for the phase of the diffracted wave, however some techniques require a substantial number of iterations and may not lead to a unique solution. We are developing a technique that utilizes multiple exposures with different impinging wavefronts on the sample to compensate for the lack of the phase information. The complementary, though independent, exposures direct the convergence and solve ambiguities in the reconstruction. This technique is optimal for few micrometer size samples, with a potential niche for biological samples like small cells and viruses. Both the data acquisition time (a few exposures) and reconstruction time (tens of iterations) are short enough such that many projections of a sample may be efficiently recorded, reconstructed and rendered into a three dimensional image. The technique, simulations and the first results from a demonstration experiment with 6 keV X-rays will be discussed in this presentation.





Left: An SEM image of a 700 nm thick “PSI logo” and the illumination area defining pinhole. Right: The reconstructed phase profile of this test sample.

References:

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